Klamath River Fall Chinook Age-Specific Escapement, 2002 Run[1]

Klamath River Technical Advisory Team
4 March 2003

Executive Summary

The number of Klamath River fall chinook returning to the Klamath River Basin in 2002 was estimated to be

Age	Number	Proportion
2	9,246	0.05
3	94,229	0.56
4	62,137	0.37
5	3,684	0.02
Total	169,297	

Klamath Ocean Harvest Model preseason forecasts of fall chinook to the Klamath River Basin and their postseason estimates are:

Sector	Adult Preseason Forecast	Adult Postseason Estimate
Run Size	132,649	160,051
Tribal Harvest	50,430	24,126
Recreational Harvest	20,451	10,410
Hatchery Spawners	21,965	27,180
Natural Area Spawners	35,000	65,646

Age-specific returns to the Basin's hatcheries and spawning grounds, and harvest in the Basin's tribal and recreational fisheries are presented in Table 1.

Introduction

This report describes the data and methods used by the Klamath River Technical Team (KRTAT) to estimate age-specific numbers of fall chinook returning to the Basin in 2002. The estimates provided in this report are compatible and consistent with the so-called Klamath River Megatable (CDFGa 2003) and with the 2003 forecast of ocean stock abundance (KRTAT 2003).

Age-specific escapement estimates for 2002 and previous years, coupled with the coded-wire tag recovery data on the Basin's hatchery stocks, allow for a cohort reconstruction of the hatchery and natural components of Klamath River fall chinook (KRTAT 2003, Goldwasser et al. 2001). Cohort reconstruction results enable forecasts to be developed of the upcoming year's ocean stock abundance, percent of spawners expected in natural areas and ocean fishery contact rates, as described in a companion report (KRTAT 2003). These forecasts are essential inputs to the Klamath Ocean Harvest Model (Mohr et al. 2001); the model used by the Pacific Fishery Management Council to forecast the effect of fisheries on the Klamath River fall chinook stock.

In late September 2002, there was a large die-off of salmon in the lower Klamath River. The cause of death, infection by the ciliated protozoan *Ichthyopthirius multifilis* (ICH) and the bacterial pathogen *Flavobacter columnare* (columnaris), is believed to have been triggered by the combination of low river flows, high fish density, and high water temperatures (CDFGb 2003). The number of adult fall chinook dying in this event was conservatively estimated to be 30,550.

[1] An earlier version of this report was issued 27 February 2003.

Methods

The basic approach used by the KRTAT to develop age-specific estimates of returning fall chinook to the Basin's hatcheries, spawning grounds, and fisheries, was to develop an age-composition estimate for each sector and then apply this composition to the corresponding sector total (age-unspecific) reported in the Klamath River Megatable. Random sampling methods of various types were used throughout the Basin (Table 2) to obtain the data from which the Megatable totals and the age-composition estimates were derived.

Where possible, an age composition estimate was based on the reading of a random sample of scales (Table 3). For Trinity River ageing, each scale was read independently by two readers, and a third reader was used to resolve any disagreement between the two primary readers. For Klamath River ageing, each scale was read independently by two readers, and any disagreement was resolved by the two readers re-reading the scale together and agreeing upon a single age. Statistical methods (Kimura and Chikuni 1987, Cook and Lord 1978, Cook 1983) were then used to correct for the possibility of reader ageing-bias, by correlating known-age cwt scales with their corresponding scale-read age assignments.

In some cases, however, the scale sample was either known or thought to be non-random with respect to the jack component. In these cases, the so-called length "cutoff" method (all fish less than a certain length are assumed to be jacks, and all fish greater than that length are assumed to be adults) was used to estimate the jack component percentage based on a random sample of length frequencies. The length "cutoff" value varied by sector and was based on the location of the sample length frequency nadir, and if appropriate, known-age (cwt) length frequencies. Scale reading was used to estimate the adult age composition in these instances.

In still other cases, the scale sample size was insufficient to develop a reliable age composition estimate, or was altogether lacking. In these cases the KRTAT used "surrogate" age composition estimates from other sectors where such estimates were available, and were thought most likely to reflect the age composition of the sector of interest.

For Trinity River natural area spawners, an indirect method was used as follows. Age-specific numbers of fall chinook passing the Willow Creek Weir (WCW) were estimated by applying the WCW scale-age composition to the above WCW total run size estimate. Next, the age composition of Trinity River Hatchery (TRH) returns, and angler harvest between WCW and TRH, were determined based on scale-age assessments and any known-age cwt fish collected at these recovery points. Natural area spawner age composition was then taken as the difference between the WCW run-size at age and the sum of TRH returns and the angler harvest above WCW. The resulting age composition for the natural escapement above WCW was assumed to apply to Trinity River natural area spawners both above and below WCW.

Results

The specific protocol used to develop age composition estimates in each sector are provided in Table 4, and a summary of the KRTAT surrounding discussion is given in Appendices A and B for the Klamath and Trinity Rivers, respectively.

A total of 14,197 scales from 18 different sectors were read (Table 3), and of these 436 and 916 were cwt'd fish from the Klamath and Trinity Rivers, respectively. The scale-age results for these cwt fish provides a direct check on the accuracy of the scale read age assignments, and allowed us to estimate the known-age, scale-age "validation" matrix used in the bias correction statistical methods (Tables 5a, 5b). Overall, the scale readings were quite accurate and precise, particularly in the case of the Trinity River (>98% accuracy, ages 2,3,4). Age-5 scales were particularly difficult to read. The statistical bias correction methods employed can account for this type of bias, but the

methods assume that the known-age, scale-age "validation" matrices are themselves well-estimated. This is suspect for the age-5 component due to the small sample sizes involved.

The resulting sector-specific age composition is given in Table 6, and summarized in Table 1. Calculations underlying the results for the Klamath and Trinity Rivers are presented in Appendices C and D, respectfully.

Literature Cited

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Acknowledgements

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Table 1. Age Composition of the 2002 Klamath River fall chinook run as determined by the Klamath River Technical Advisory Team, with assistance from CDFG's Klamath and Trinity River projects.*

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	1,296	13,425	10,183	57	23,665	24,961
Trinity River (TRH)	1,034	2,431	1,004	80	3,515	4,549
Hatchery Spawner subtotal	**2,330**	**15,856**	**11,187**	**137**	**27,180**	**29,510**
Natural Spawners						
Salmon River basin	72	1,206	1,279	0	2,486	2,558
Scott River basin	47	2,479	1,656	127	4,261	4,308
Shasta River Basin	386	4,286	2,088	58	6,432	6,818
Bogus Creek Basin	305	15,373	2,130	27	17,529	17,834
Klamath River mainstem (IGH to Shasta R)	503	8513	7985	44	16,542	17,045
Klamath River mainstem (Shasta R to Indian Cr)	155	2629	2466	14	5,108	5,263
Klamath Tributaries above Reservation	44	775	551	18	1,344	1,388
Yurok Reservation Tributaries	12	165	174	0	339	351
Klamath Basin subtotal	1,524	35,426	18,329	286	54,041	55,565
Trinity River mainstem above WCW	2,217	6,741	3,327	813	10,881	13,098
Trinity River mainstem below WCW	40	120	59	14	194	234
Trinity Tributaries above Reservation	66	201	99	24	324	390
Hoopa Reservation Tributaries	42	128	63	15	206	248
Trinity Basin subtotal	2,365	7,190	3,548	866	11,605	13,970
Natural Spawners subtotal	**3,889**	**42,616**	**21,877**	**1,152**	**65,646**	**69,535**
Total Spawner Escapement	**6,219**	**58,472**	**33,064**	**1,289**	**92,826**	**99,045**
Angler Harvest						
Klamath River (below Hwy 101 bridge)	274	1,784	1,414	87	3,285	3,559
Klamath River (Hwy 101 to Coon Cr. Falls)	283	1,777	1,407	86	3,269	3,552
Klamath River (Coon Cr. Falls to IGH)	93	2,126	1,089	0	3,216	3,309
Trinity River basin (above WCW)	170	415	57	1	473	643
Trinity River basin (below WCW)	51	80	87	0	167	218
Subtotals	**871**	**6,182**	**4,054**	**174**	**10,410**	**11,281**
Indian Net Harvest						
Klamath River (below Hwy 101)	17	9,226	9,701	774	19,701	19,718
Klamath River (Hwy 101 to Trinity mouth)	41	1,713	1,440	104	3,257	3,298
Trinity River (Hoopa Reservation)	68	579	557	32	1,168	1,236
Subtotals	**126**	**11,518**	**11,698**	**910**	**24,126**	**24,252**
Total in-river Harvest	**997**	**17,700**	**15,752**	**1,084**	**34,536**	**35,533**
Totals						
In-River Harvest and Escapement	7,216	76,172	48,816	2,374	127,362	134,578
Angling Mortality (2% of harvest)	17	124	81	4	209	226
Net Mortality (8% of harvest)	10	921	936	73	1,930	1,940
Fish Die Off	2,003	17,012	12,304	1,233	30,550	32,553
Total In-river Run	**9,246**	**94,229**	**62,137**	**3,684**	**160,051**	**169,297**

*Preliminary Feb 18, 2002 (special thanks to Wade Sinnen)
(Excel .xls version)

Table 2. Documentation of the methods used to sample 2002 Klamath River fall chinook run.

Sampling Location	Estimation Method	Agency
Hatchery Spawners		
Iron Gate Hatchery (IGH)	Direct count. All fish examined for fin clips, tags, marks. Systematic random sample ~10% bio sampled for FL, scales, sex.	CDFG
Trinity River (TRH)	Direct count. All fish bio sampled for FL, fin-clips, marks sex. Scales collected from all Ad clipped fish and ~10% of non Ads.	CDFG
Natural Spawners		
Trinity River mainstem above WCW	Peterson mark-recapture run-size estimate. All fish at weir bio sampled for FL, marks, fin-clips. Scale samples taken from all Ad-clipped fish and every other non Ad clipped fish.	CDFG
Trinity River mainstem below WCW	Adult escapement estimate based on Redd count times 2. Several surveys performed. Count is additive for survey period.	HVT
Salmon River basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio data (scales, FL's' marks) collected from all fresh carcasses.	CDFG,USFS
Scott River basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio data (scales, FL's' marks) collected from all fresh carcasses.	CDFG
Shasta River Basin	Video count at lower river weir site. Bio data (Scales, FL's, sex, marks) collected from carcasses upstream of site. Attempt to recover 10% of estimate	CDFG
Bogus Creek Basin	Peterson mark-recapture estimate above weir, carcass count below weir. Fish are biosampled (scales, FL's, sex, fin-clips) during recapture spawning ground surveys.	CDFG
Klamath main stem (IGH to Shasta R)	Mark-recapture carcass estimate. River sections are surveyed once weekly. Bio data (scales, FL's' marks) collected from fresh carcasses.	USFWS
Klamath main stem (Shasta R to Indian Cr)	Redd count based on weekly surveys. Cumulative count based on flagging old redds. Adult estimate is redds times 2.	USFWS
Trinity Tributaries above Reservation	Only 1 trib, Horse Linto Cr. Adult estimate based on weekly redd counts. Previous weeks redds flagged to avoid double counting.	USFS
Klamath Tributaries above Reservation	Periodic redd surveys. Prior weeks redds flagged, only new redds counted. Estimate is redds times 2 + live fish observed on last survey date.	USFS,CDFG
Hoopa Reservation Tributaries	Adult estimate based on redd surveys. Survey redd totals are cumulative. Final adult estimate is redds times 2.	HVT
Yurok Reservation Tributaries	Only surveyed stream is Blue Creek. Jacks and adult count based on the peak weekly snokle survey. Weekly dives performed Oct - Dec.	YT
Angler Harvest		
Klamath River (below Hwy 101 bridge)	Estimate is based on a stratified access point creel survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Hwy 101 to Coon Cr. Falls)	Estimate is based on a stratified access point creel survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Coon Cr. Falls to IGH)	Estimate based on a stratified access/roving creil survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	CDFG
Trinity River basin (above WCW)	Estimate is based on the return of reward tags placed on fish at weir. Return rate is applied to run-size estimate to estimate harvest.	CDFG
Trinity River basin (below WCW)	Estimate based on a stratified roving/access creel survey. Bio data (scales, FL's, marks, fin-clips) collected during angler interviews.	HVT
Indian Net Harvest		
Klamath River (below Hwy 101)	Stratified effort/catch surveys. Bio data (FL's, scales, fin-clips) collected during net harvest interviews.	YT
Klamath River (Hwy 101 to Trinity mouth)	Stratified effort/catch surveys. Bio data (FL's, scales, fin-clips) collected during net harvest interviews.	YT
Trinity River (Hoopa Reservation)	Two stage stratified effort/catch surveys. Bio data (FL's, scales, fin-clips) collected during net harvest interviews.	HVT
Fish Die Off	Peak count estimate. Three separate strata were surveyed between the mouth and Coon Cr. Falls. Subsampled strata were expanded for their entirety based on numbers/length. Bio data was collected during the counts and independently during supplementary surveys.	USFWS

Table 3. Scale sampling locations and numbers of scales collected for the 2002 Klamath River Basin fall chinook age-composition.

Sampling Location	Total Scales	Unknown Scales	CWT Scales	Not Used	Agency
Hatchery Spawners					
Iron Gate Hatchery	2,465	1,721	581	163	CDFG
Trinity River Hatchery	1,552	649	869	34	HVT
Natural Spawners					
Klamath River mainstem	290	274	0	16	USFWS
Salmon River Carcass Survey	475	460	0	15	CDFG, USFS
Scott River Carcass Survey	433	422	0	11	CDFG
Shasta River Weir & Carcass	264	234	0	30	CDFG
Bogus Creek Weir	2,453	1,335	30	1,088	CDFG
Upper Klamath River Tribs	58	29	0	29	CDFG, USFS
Lower Trinity River Carcass	15	15	0	0	HVT
Willow Creek Weir	365	322	28	15	CDFG, HVT
Angler Harvest					
Lower Klamath River Creel Census	1,851	1,719	76	56	CDFG
Upper Klamath River Creel Census	430	413	0	17	CDFG
Lower Trinity River Creel	66	61	4	1	HVT
Upper Trinity River Creel	20	14	6	0	CDFG
Net Harvest					
Hoopa Tribal Net Harvest	412	372	35	5	HVT
Yurok Tribal Net Harvest (Mouth to Hwy 101)	1,646	1,506	67	73	YT
Yurok Tribal Net Harvest (Hwy 101 to Weitchpec)	1,123	1,009	7	107	YT
Fish Die Off	279	268	0	11	CDFG, HVT, USFWS, YT
TOTAL	14,197	10,823	1,703	1,671	

Table 4. Documentation of the methods used by the KRTAT to determine the age composition of the 2002 Klamath River fall chinook run.

Age computation methods	
Hatchery Spawners	
Iron Gate Hatchery (IGH)	Actual count; jack, adult breakout from scale age analysis.
Trinity River (TRH)	Actual count; jack, adult breakout from scale age analysis.
Natural Spawners	
Trinity River mainstem above WCW	Calculated from total Willow Creek Weir (age structure from scales) population minus TRH (age structure from scales) minus recreational harvest (jacks from harvest rate used in CDFG Megatable(MT); adults from scales).
Trinity River mainstem below WCW	Used age% from TR nat. spawners mainstem above WCW to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Salmon River basin	FL< =59 for jacks (2.2%); adult structure from scale age analysis.
Scott River basin	Jack, adult breakout from scale age analysis. Surveyed only 8 reaches but > 99% of the run sampled due to low water levels (Mark Hampton, pers comm).
Shasta River Basin	Jack, adult breakout from scale age analysis.
Bogus Creek Basin	Jack, adult breadout from scale age analysis.
Klamath main stem (IGH to Shasta R)	USFW mark-recapture carcass survey; used Schaefer estimate for total adults; jack, adult breakout from scale analysis.
Klamath main stem (Shasta R to Indian Cr)	Used scale age% from Klamath main stem (IGH to Shasta R) as surrogate to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Trinity Tributaries above Reservation	Used age% from TR nat. spawners mainstem above WCW as surrogate to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Klamath Tributaries above Reservation	unweighted average age structure from the Shasta, Scott, and Salmon Rivers (surrogate).
Hoopa Reservation Tributaries	Used age% from TR nat. spawners mainstem above WCW as surrogate to calculate jack and adult structure; adults= 2*redd counts; total run=adults/(1-%jacks).
Yurok Reservation Tributaries	Number of jacks and adults observed during Blue Creek dive surveys; Salmon River scales age analysis used as surrogate for adult age structure.
Angler Harvest	
Klamath River (below Hwy 101 bridge)	Lower Klamath R. creel census, jacks & adult structure from scale age analysis
Klamath River (Hwy 101 to Coon Cr. Falls)	Lower Klamath R. creel census, jacks & adult structure from scale age analysis
Klamath River (Coon Cr. Falls to IGH)	Upper Klamath R. creel census, jacks & adult structure from scale age analysis
Trinity River basin (above WCW)	Jacks based on harvest rate; adult structure from scale age analysis.
Trinity River basin (below WCW)	Lower Trinity R. creel census; jack and adult structure from scale age analysis.
Indian Net Harvest	
Klamath River (below Hwy 101)	FL< 61 for jacks, adult structure from scale age analysis.
Klamath River (Hwy 101 to Trinity mouth)	Total count; jack and adult structure from scale age analysis.
Trinity River (Hoopa Reservation)	Total count; jack and adult structure from scale age analysis.
Fish Kill	Jack and adult breakout from scale age analysis.

Table 5a. 2002 Klamath River scale validation matrices.

Number

Read Age	Known Age 2	3	4	5
2	15	1	0	0
3	1	246	21	0
4	0	4	146	1
5	0	0	0	1
Total	16	251	167	2

Percentage

Read Age	Known Age 2	3	4	5
2	0.94	0.00	0.00	0.00
3	0.06	0.98	0.13	0.00
4	0.00	0.02	0.87	0.50
5	0.00	0.00	0.00	0.50
Total	1.00	1.00	1.00	1.00

Table 5b. 2002 Trinity River scale validation matrices.

Number

Read Age	Known Age 2	3	4	5
2	256	0	0	0
3	0	404	5	0
4	0	5	230	6
5	0	0	0	10
Total	256	409	235	16

Percentage

Read Age	Known Age 2	3	4	5
2	1.00	0.00	0.00	0.00
3	0.00	0.99	0.02	0.00
4	0.00	0.01	0.98	0.37
5	0.00	0.00	0.00	0.63
Total	1.00	1.00	1.00	1.00

Table 6. 2002 age-composition results.

Klamath Basin Age Comp (Jan 29-31,2003)

Hatchery spawners	MEGATABLE Grilse	Adults	Total	NUMBERS AT AGE 2	3	4	5	Total	PROPORTIONS AT AGE	2	3	4	5	Total	Scales read (n=)	Redd counts / notes
Iron Gate Hatchery	1296	23665	24961	1296	13425	10183	57	24961	scales	0.05248	0.53477	0.41045	0.00231	1.0	1,734	
									IGH cwts	16	396	183	1	596		
Trinity	1034	3515	4549	1034	2431	1004	80	4549	scales	0.21451	0.55755	0.21028	0.01767	1.0	634	
Hatchery spawner subtotal:	2330	27180	29510	2330	15856	11187	137	29510	TRH cwts	257	412	242	16	927		
Natural Spawners																
Trinity River mainstem above WCW	2217	10881	13098	2217	6741	3327	813	13098	see notes	0.16924	0.51469	0.25403	0.06204	1.0	See Scale Analysis notes next page	
Trinity River mainstem below WCW	40	194	234	40	120	59	14	234	TR nat above	0.16924	0.51469	0.25403	0.06204			97
Salmon River Basin-includes Wooley Cr.	72	2486	2558	72	1206	1279	0	2558	scales	0.02826	0.47162	0.50012	0.00000	1.0	460	
Scott River	47	4261	4308	47	2479	1656	127	4308	scales	0.01084	0.57543	0.38436	0.02938	1.0	422	
Shasta River	386	6432	6818	386	4286	2088	58	6818	scales	0.05659	0.62859	0.30627	0.00855	1.0	234	
Bogus Creek	305	17529	17834	305	15373	2130	27	17834	scales	0.01711	0.86260	0.11879	0.00150	1.0	1,335	
									Bogus CWT	0	17	15	0	32		
Main stem Klamath (IGH to Shasta R)	503	16542	17045	503	8513	7985	44	17045	scales	0.02949	0.49945	0.46848	0.00258	1.0	776	#adults from carcass
Main stem Klamath (Shasta R to Indian Cr)	155	5108	5263	155	2629	2466	14	5263	Upper main	0.02949	0.49945	0.46848	0.00258	######	Surrogate -upper main	2554
subtotal:	3,725	63,433	67,158	0 3,725	41,347	20,990	1,097	67,158			0.5146	0.4827	0.0027			
									Unweighted Scott Shasta Salmon (SSS) - SURROGATE							
	Surrogate								SSS	0.03189	0.55855	0.39692	0.01264	1.0		
Klamath Tributaries																Redds live adults
Aiken Cr.	0	14	14	0	8	6	0	14	SSS	0.03189	0.55855	0.39692	0.01264			7 0
Beaver Cr.	3	98	101	3	57	40	1	101	SSS	0.03189	0.55855	0.39692	0.01264			34 30
Bluff Cr.	1	34	35	1	20	14	0	35	SSS	0.03189	0.55855	0.39692	0.01264			15 4
Boise Cr.	0	12	12	0	7	5	0	12	SSS	0.03189	0.55855	0.39692	0.01264			6 0
Camp Cr.	6	178	184	6	103	73	2	184	SSS	0.03189	0.55855	0.39692	0.01264			86 6
Clear Cr.	10	314	324	10	181	129	4	324	SSS	0.03189	0.55855	0.39692	0.01264			157 0
Dillon Cr.	1	33	34	1	19	14	0	34	SSS	0.03189	0.55855	0.39692	0.01264			16 1
Elk Cr.	8	236	244	8	136	97	3	244	SSS	0.03189	0.55855	0.39692	0.01264			117 2
Grider Cr.	8	230	238	8	133	94	3	238	SSS	0.03189	0.55855	0.39692	0.01264			115 0
Horse Cr.	1	29	30	1	17	12	0	30	SSS	0.03189	0.55855	0.39692	0.01264			11 7
Independence Cr.	0	0	0	0	0	0	0	0	SSS	0.03189	0.55855	0.39692	0.01264			0 0
Indian Cr.	0	4	4	0	2	2	0	4	SSS	0.03189	0.55855	0.39692	0.01264			1 2
Irving Cr.	0	0	0	0	0	0	0	0	SSS	0.03189	0.55855	0.39692	0.01264			0 0
Perch Cr.	0	0	0	0	0	0	0	0	SSS	0.03189	0.55855	0.39692	0.01264			0 0
Red Cap Cr.	4	108	112	4	62	44	1	112	SSS	0.03189	0.55855	0.39692	0.01264			53 2
Thompson Cr.	2	54	56	2	31	22	1	56	SSS	0.03189	0.55855	0.39692	0.01264			27 0
Ti Cr.	0	0	0	0	0	0	0	0	SSS	0.03189	0.55855	0.39692	0.01264	######		0 0
Klamath Tribs subtotal	44	1344	1388	44	775	551	18	1388			0.57695	0.40999	0.01306			645 54
Trinity Tributaries																
Horse Linto Cr.	53	258	311	53	160	79	19	311	TR nat above	0.16924	0.51469	0.25403	0.06204	1.0		129
Cedar Cr (trib to Horse Linto)	13	66	79	13	41	20	5	79	TR nat above	0.16924	0.51469	0.25403	0.06204	1.0		33
subtotal	66	324	390	66	201	99	24	390								
Non-Reservation Misc. tribs sub total	110	1668	1778	110	976	650	42	1778								
Reservation Tributaries-Hoopa Valley																live adults
Campbell Cr.	0	0	0	0	0	0	0	0	TR nat above	0.16924	0.51469	0.25403	0.06204			0 0
Hostler	1	4	5	1	2	1	0	5	TR nat above	0.16924	0.51469	0.25403	0.06204			2 0
Mill	24	118	142	24	73	36	9	142	TR nat above	0.16924	0.51469	0.25403	0.06204			59 30
Pine Cr.	2	10	12	2	6	3	1	12	TR nat above	0.16924	0.51469	0.25403	0.06204			5 3
Soctish	0	0	0	0	0	0	0	0	TR nat above	0.16924	0.51469	0.25403	0.06204			0 0
Supply Cr.	3	14	17	3	9	4	1	17	TR nat above	0.16924	0.51469	0.25403	0.06204			7 6
Tish Tang Cr.	12	60	72	12	37	18	4	72	TR nat above	0.16924	0.51469	0.25403	0.06204			30 47
Others	0	0	0	0	0	0	0	0	TR nat above	0.16924	0.51469	0.25403	0.06204			0 0
subtotal	42	206	248	42	128	63	15	248								
Reservation Tributaries-Yurok																
Blue Cr.	12	339	351	12	165	174	0	351	Salmon R	not used	0.47162	0.50012	0.00000	0.97		
reservation tributaries subtotal	54	545	599	54	293	237	15	599								
Natural spawner subtotal:	3889	65646	69535	3889	42616	21877	1154	69535		65647						
Total spawner subtotal:	**6219**	**92826**	**99045**	**6219**	**58472**	**33064**	**1291**	**99045**								
Angler Harvest															Scales read (n=)	
Klamath River-below Hwy 101	274	3285	3559	274	1784	1414	87	3559	LRC scales	0.07667	0.50147	0.39742	0.02443	1.00	1,719	
									LRC cwts	3	12	10	1	26		
Klamath River- Hwy 101 to Coon Cr	283	3269	3552	283	1777	1407	86	3552	LRC scales	0.07667	0.50147	0.39742	0.02443	1.00	1,719	
									LRC cwts	14	21	15	0	50		
Klamath River- Coon Cr. to IGH	93	3216	3309	93	2126	1089	0	3309	URC scales	0.02826	0.64280	0.32894	0.00000	1.00	413	
									URC cwts	0	1	2	0	3		
Trinity River-below Willow Cr. weir	51	167	218	51	80	87	0	218	scales	0.22951	0.37316	0.39733	0.00000	1.00	61	
									lower cwts	2	0	2	0	4		
Trinity River-upstream of Willow Cr. weir	170	473	643	170	415	57	1	643	scales	See notes	0.8833	0.1167	0	1.00	14	#jacks-harvest rate
Angler harvest subtotal:	871	10,410	11,281	871	6,182	4,054	174	11,281	upper cwts	See notes	6	3	1	9		CWTs expanded by harvest rate
Indian Net Harvest																
Klamath River-Below 101 hwy	17	19701	19718	17	9226	9701	774	19718	scales	0.00084	0.46830	0.49232	0.03854	1.00	1,505	
									YTFP EST cwt		31	35	1	67		
Klamath River-101 to Trinity	41	3257	3298	41	1713	1440	104	3298	scales	0.01256	0.51949	0.43630	0.03165	1.00	1,011	
									YTFP MU cwt	0	3	4	0	7		
Trinity River	68	1168	1236	68	579	557	32	1236	scales	0.05660	0.46227	0.45525	0.02588	1.00	371	
Net harvest subtotal:	126	24126	24252	126	11518	11698	910	24252	Hoopa cwts	0	24	10	1	35.00		
Total harvest	**997**	**34536**	**35533**	**997**	**17700**	**15752**	**1084**	**35533**								
Totals																
In-river run and escapement	7216	127362	134578	7216	76172	48816	2375	134578								
Angling mortality (2% of harvest)	17	209	226	17	124	81	4	226								
Net mortality (8% of harvest)	10	1930	1940	10	921	936	73	1940								
Fish Die off	2003	30550	32553	2003	17012	12304	1233	32553	Fish Kill scales	0.06137	0.52274	0.37795	0.03794	1.00	369	
									LRC cwts	9	25	22	0	56		
Total in-river run	9246	160051	169297	9246	94229	62137	3684	169297								

Appendix A. Klamath River – 2002 Details.

Iron Gate Hatchery
After the following discussion, the KRTAT decided to use scale-age-based determination of the jack proportion at IGH.

Mark Hampton indicated that the proportion of jacks at IGH was estimated as 4.8% based on non-known age length frequencies of males and females at 62 cm and less. Further, based on length frequencies for cwt fish, there was a broad spread of lengths for two-year-old fish. Hence, when comparing a length frequency of known aged fish from IGH it appeared that accepting a cutoff of 62 cm leads to inclusion of many three year old cwt aged fish. Only 18 known-age jacks were in these distributions. If the jack cutoff was placed at 63 cm, the proportion of jacks would be 5.7%.

There was some confusion as to which sample was being discussed here; random, or an every fish sample. A sampling resolution problem occurs since operators do not record length/scale etc on individual fish as a function of return timing or time of spawning. Fish return to the hatchery continually, are sorted, and spawned at various times. Hence, it is important to conduct sampling at a constant rate during actual recovery events.

Desma Williams presented scale-age-based segregation of jacks/adults. The validation matrix was reviewed for the Klamath River. Reader error was highest for the case of four year old fish being mis-classified as three year olds based on scales. Otherwise, a very slight reader bias was observed for fish being read as three-year-olds which were actually two-year-olds. The scale-based proportion of jacks was 5.3%. The proportion of two-year-olds was 5.2% when the cwt known-aged fish were added in.

Desma Williams described her scale mounting procedure for IGH where not all known-age fish correspond to a mounted and aged scale. It was suggested for next year that the IGH scale collection/mounting/ageing procedure include all ad-clipped fish from IGH and await to receive known age data from CDFG in order to augment the Klamath scale-age correction matrix. Otherwise, the procedure is to obtain ages from cwts by projecting these known age fish age proportions upon the remaining ad-clipped fish for which no cwt was obtained. Age proportions for randomly sampled, non-ad-clipped fish are projected on the non-ad-clipped portion of the total IGH return and these proportions become the total number by age for the non-ad fish. Later, the known ages are combined to these total counts.

Desma Williams observed some scale delivery problems. Both Mark Hampton and Sara Borok agreed that there were "too many hands in the pot", leading to some confusion on the delivery of scale samples. In the case of the Salmon and Scott rivers, there were extensive collections of scales that were apparently mis-placed. At this time, we proceeded with review of results to date. Search for these scales was to continue in the coming days.

Bogus Creek
Mark Hampton's analysis of length frequencies for Bogus males indicated a break of 63 cm and less. Sara Borok's (all data) summary found that if 63 cm break was used, 2.2% of the return were classified age-2 fish. Scale age distributions predict 1.7% jacks. No apparent bias with scale age was identified. The scale-age-based proportion was used.

Shasta River
Based upon length frequencies, Mark Hampton estimated a jack proportion of 6.7% for male fish 63 cm and less. Examination of 234 scale predicts that 5.7% are age-2. The Team concluded there was no reason to reject scale age structure for the jacks in the Shasta River, and so accepted this method.

Mark Hampton stated that next year he will be implementing a video counting weir in the Shasta River, and thus scale sample sizes will likely be smaller in the future.

Scott River
Only 225 scales were collected from 1,795 fish examined. The Team concluded that the sample size for scales must be increased in the future. Based upon length frequencies, Sara Borok concluded that jacks constituted 0.94% for both sexes of fish 60 cm and less. Examination of the 225 scales indicated that 1.1% are age-2. The Team found that there was no reason to reject scale age structure for the jacks in Scott River, and thus accepted this method. (At the stock projection meeting ageing results of over two-hundred additional scales provided after the age-composition meeting were discussed by Desma Williams, annotation of 2/11/03. The results from these additional scales have been folded into the results of this report, annotation of 2/26/03.)

Salmon River
Based upon length frequencies, Sara Borok concluded that jacks constituted 1.9% for both sexes of fish 55 cm and less of 1,245 fish examined. Examination of the scales predicted that 0% are age-2 (no scales were aged as two-year-olds in the 44 scales provided). Accordingly, the Team preliminarily used the jack count based on length frequencies. Note that typically, jacks are "small" in the Salmon River, and this year was no exception. Upon further work with the length frequencies, a jack "cut off" of 58 cm and less resulted in a two-year-old proportion of 0.022. (At the stock projection meeting ageing results of over two-hundred additional scales provided after the age-composition meeting were discussed by Desma Williams, annotation of 2/11/03. The results from these additional scales have been folded into the results of this report, annotation of 2/26/03.)

Miscellaneous Tributaries in Klamath
These tributaries were to be proportioned by age according to the un-weighted average proportions resulting from the Salmon, Scott, and Shasta Rivers.

Klamath Mainstem
For IGH to Shasta River section, 776 scales were read which resulted in a jack proportion of 3%. Isaac Sanders had reported 4.3% jacks. The Team concluded to apply the jack proportion based on scale ageing given the large sample size and its representational nature relative to the total estimate. This produced 508 jacks in the mainstem escapement. For Shasta River to Indian Creek, last year the surrogate age structure from mainstem above was used, and the Team decided to use this approach again this year. The number of fish estimated to spawn in this reach totaled 5,108 adults and 157 jacks on 2,554 redds.

Lower Klamath River creel
Sara Borok reported that using a break of 61cm and less resulted in a jack proportion of 8.6%. This compared with the scale-aged distribution of 7.9% jacks. When Sara Borok dropped the "cut off" to 59 cm, she found a 7.9% jack proportion. The scale-age jack proportion was used.

Upper Klamath River creel
The majority of harvest occurs in the IGH to I-5. Sara Borok reported that using a break of 61cm and less resulted in a jack proportion of 4.0%. This compared with the scale-aged distribution of 2.9% jacks. A total of 413 scales were read from this fishery. When Sara Borok dropped the "cut off" to 59 cm she found a 4.1% jack proportion. The scale-age jack proportion was used.

Yurok Tribal Estuary Fishery
The estuary fishery scale sample yielded a jack proportion of 0.008. A fork length "cut off" of less than 61 cm on the length distributions for the aged scales was examined. Scale-based age composition for the jack proportion was used.

Yurok Tribal Above 101
Yurok harvest in the mid and upper-Klamath area was segregated into jacks and adults based upon scale ageing.

Blue Creek

Snorkel surveys were used to produce total escapement estimate. Visual counts revealed 12 jacks and 339 adults. Adult age composition was approximated using the age structure of Salmon River as a surrogate. Blue Creek chinook run late (peak snorkel count was 21 November) and are not encountered in significant numbers in any fishery. Hence, little biological data exists for direct age-apportionment of this run. In years previous, the SSS age composition or Salmon River alone was used.

Klamath Fish Die-off

In comparison to the lower river creel, the Klamath fish die-off resulted in a very similar jack proportion as indicated by scale ageing or length distributions. Further, based on a length "cut off" using 60 cm and less for observed carcass length frequencies, the jack proportion was 0.073. The scale-age method produced and estimated 0.062 jack proportion. Melodie Palmer-Zwahlen clarified that she has a list of 56 known aged cwt fish while Desma William's age composition accounts for only 36 of them. Using this full sets of CWTs did not change the jack proportion. Overall, with no issues over the validity of the fish die-off scale samples, the Team found there was no reason not to use the scale age proportions for both jacks and adults, and this was done.

Appendix B. Trinity River – 2002 Details.

Trinity River Hatchery
Sampling for scales was conducted in a systematic random manner in which every tenth fish was selected for a sample. In addition, every ad-clipped fish was taken. A total of 1,518 scales were aged of which 927 scales came from CWT fish both randomly and non-randomly selected. This was the largest validation component for the entire Trinity River ageing project Jacks were identified by scales, as were the age proportions for adult classes.

Upper Trinity Creel
Very low biological sampling of the total estimated harvest of 637 fish in this fishery resulted in very few scale samples. In the sample of 20 scales, only 14 were found to be useable of which 6 were of known-age. Hence, the KRTAT decided that the least biased estimate for jack proportions was to utilize the Megatable supplied value. In this case, Wade Sinnen described his approach for estimating the harvest of jacks and adults. The approach depends upon the recovery of reward/non-reward program tags applied at the Willow Creek Weir (WCW) and subsequently recovered by the program. From this information adult- and jack-specific harvest rates are calculated and used to generate the respective harvest totals.

The Team decided that the direct creel estimate associated with a length-frequency jack "cut off" would not be as accurate. The census was curtailed prior to end of season due to budget constraints. While the jack proportion was determined from the harvest rate approach described above, age structure for the adult harvest was derived from the few scales available since they appeared representative of the distribution of 54 lengths obtained in that fishery. The Team recommended that, assuming funds allow, CDFG should consider increasing the bio-sampling of this fishery in future years.

Lower Trinity Creel
A total of 65 scales were aged of which 4 were from known-age fish. Team concluded that sufficient scale samples were drawn to enable direct ageing by scales for all ages.

Upper Trinity natural escapement
The methods used for ageing the Trinity River run above WCW are similar to those used in the estimation of the population, apportioned to three general recovery areas; Trinity River Hatchery, Trinity upper-basin natural spawning escapement, and recreational harvest. At WCW a systematic-random sampling of all fish examined produces a collection of scales for program marked fish, some of which are ad-clipped (Trinity River Hatchery origin). An additional, non-random sample of scales is collected from every ad-clipped fish missed in the random-systematic sample. This is done to enhance the likelihood of CWT matches for scales from ad-clipped fish collected at WCW pending possible upriver recovery. Validation of WCW read scales is accomplished with know-aged fish later recovered at either TRH, recreational creel, or spawning grounds.

An age-structure for fish passing above WCW is estimated using these scales and a few known-age fish found in upper river areas. Next, specific age structures are estimated for fish returning to TRH and the recreational fishery. These proportions are applied to the total hatchery escapement and estimated fishery harvest respectively providing totals by age within area. These totals are next deducted from the WCW run apportioned by age leaving an age-structure for the natural escapement in the Trinity River natural spawning grounds.

In the 2002 field sampling, the scale samples seemed to favor fish with adipose clips; systematic random and non-random samples were not separable. A total of 350 scales were aged of which 28 were later recovered ad-clipped fish with known ages. In arranging the available samples into a validation matrix of CWT known age vs scale aged fish, it became apparent that removal of the samples for which CWTs were ultimately recovered at either TRH, spawner surveys, or recreational creel, the resulting proportion of ad vs non-ad scale samples in the collection compared well with the ratio observed for all fish passing WCW. In short, the sample now appeared representative of the run and the emphasis on cwt fish was

removed. Accordingly, it seemed reasonable to proceed with the standard methodology whereby the corrected proportion vector be applied to all fish remaining after accounting for the TRH and recreational fishery sectors.

In the future, the random/non-random scales in these datasets should be labeled as such. The value of collecting supplemental non-random scales from all ad-clipped fish should be explored. This would better allow for an examination of scale reading error of TRH versus WCW fish. The likelihood of obtaining enough cwt age validations from randomly sampled fish only, without supplemental non-random samples, should be explored.

Lower Trinity Natural
A total of 15 scales were aged with no known-age fish in the collection. Hence, the Team opted to use upper Trinity Natural as surrogate age structure for all ages.

HVT Net Harvest
A total of 407 scales were aged of which 35 were from known-age fish. Total harvest was apportioned by age using the scale age proportions for ages 2-5.

Appendix C. 2002 Klamath scale age analysis (Feb 2003).

Unknown scales age composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	26	1150	158	1	1335
LRC	127	939	632	21	1719
URC	12	278	123	0	413
IGH	89	1004	639	2	1734
SALMON	13	217	230	0	460
SCOTT	5	243	162	12	422
SHASTA	13	154	66	1	234
YTFP EST	4	784	688	29	1505
YTFP M&U	14	571	410	16	1011
MAINSTEM	23	427	325	1	776
FISH KILL	22	208	132	7	369
UR TRIBS	0	12	10	0	22
					10000 Total unknown scales read

Unknown scales corrected age proportions (Kimura method)

		AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	p	0.01711	0.86260	0.11879	0.00150	1
LRC	p	0.07667	0.50147	0.39742	0.02443	1
URC	p	0.02826	0.64280	0.32894	0.00000	1
IGH	p	0.05248	0.53477	0.41045	0.00231	1
SALMON	p	0.02826	0.47162	0.50012	0.00000	1
SCOTT	p	0.01084	0.57543	0.38436	0.02938	1
SHASTA	p	0.05659	0.62859	0.30627	0.00855	1
YTFP EST	p	0.00084	0.46830	0.49232	0.03854	1
YTFP M&U	p	0.01256	0.51949	0.43630	0.03165	1
MAINSTEM	p	0.02949	0.49945	0.46848	0.00258	1
FISH KILL	p	0.06137	0.52274	0.37795	0.03794	1
UR TRIBS	p	0.00000	0.48868	0.51132	0.00000	1

Known CWT ages

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	0	17	15	0	32
LRC (see below for breakout)	17	33	25	1	76
URC	0	1	2	0	3
IGH	18	396	183	1	598
SALMON	0	0	0	0	0
SCOTT	0	0	0	0	0
SHASTA	0	0	0	0	0
YTFP EST	0	31	35	1	67
YTFP M&U	0	3	4	0	7
MAINSTEM	0	0	0	0	0
FISH KILL	9	25	22	0	56
LRC - below 101	3	12	10	1	26
LRC - above 101	14	21	15	0	50
	17	33	25	1	76

Validation Matrix

		Known Age 2	3	4	5
Read Age	2	15	1	0	0
	3	1	246	21	0
	4	0	4	146	1
	5	0	0	0	1
	Total	16	251	167	2

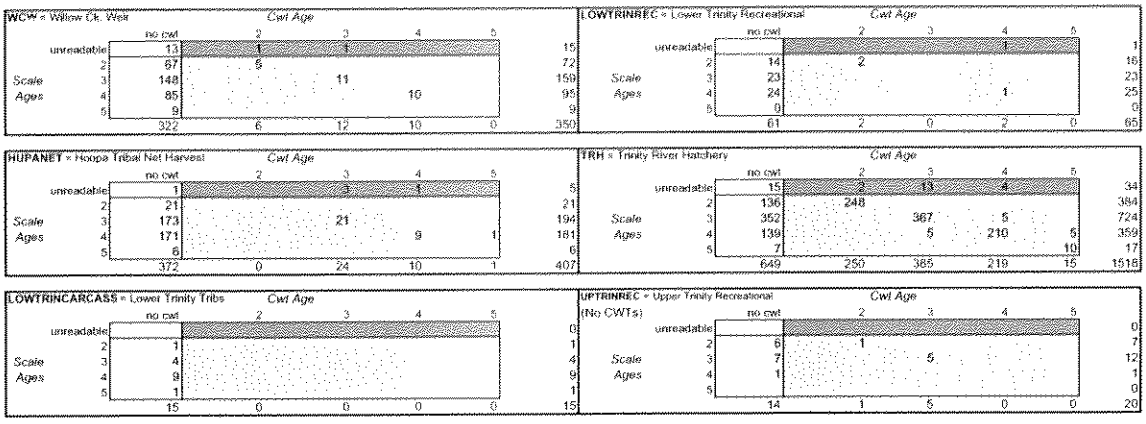
Percentages from validation matrix

		Known Age 2	3	4	5
Read Age	2	0.94	0.00	0.00	0.00
	3	0.06	0.98	0.13	0.00
	4	0.00	0.02	0.87	0.50
	5	0.00	0.00	0.00	0.50
	Total	1.00	1.00	1.00	1.00

Note: Approximately 600 additional scales from the Salmon and Scott rivers were found after the 2002 age comp meeting. These scales were read by Hoopa Tribe (Yurok staff unavailable) and verified using their validation matrix for their scale readers.

Unknown Scott and Salmon scales read by Yuroks- redistributed using corrected proportions						
Salmon	Cd 1 - 4	0	17	27	0	44
Scott	Cd 1 - 13	3	153	64	6	225
Additional scales read by Hoopa and reapportioned						
Salmon	Cd 5 - 14	9	81	93	0	183
Scott	Cd 14 - 18	1	35	57	2	95
Additional scales read by Hoopa and reapportioned - Last Batch						
Salmon	Cd 15 - 26	4	119	110	-	233
Scott	Cd 19 - 24	1	55	41	5	102
Totals:	Salmon	13	217	230	0	460
	Scott	5	243	162	12	422

Appendix D. 2002 Trinity scale age analysis (Feb 2003).



(A) POOLED data from all areas **Scale age-CWT age matrix**
(includes only fish with both scale age and CWT known age.)

Age	2	3	4	5
2	256	0	0	0
3	0	404	5	0
4	0	5	230	6
5	0	0	0	10

(B) Scale-CWT age matrix of proportions of column sums. (Note: column sums same for matrix of ages 2 - 4 as for ages 2 - 5.)

Age	2	3	4	5
2	1.0000	0.0000	0.0000	0.0000
3	0.0000	0.9878	0.0213	0.0000
4	0.0000	0.0122	0.9787	0.3750
5	0.0000	0.0000	0.0000	0.6250
	1.0000	1.0000	1.0000	1.0000

(C) Uncorrected age vectors for ages 2,3,4,5 read from UNKNOWN scales only
All unknown aged scales combined (no lower Trinity Carcass)

Age	Count	Proportion
2	244	0.17567
3	703	0.50612
4	420	0.30238
5	22	0.01584
	1389	1.00000

(no Lower Trinity Carcs)

	WCW	HUPANET	LOWTRINREC	TRH	LOWTRINCARC	UPTRINREC
2	0.2168	0.0566	0.2295	0.2145	0.0667	0.4286
3	0.4790	0.4663	0.3770	0.5552	0.2667	0.5000
4	0.2751	0.4609	0.3934	0.2192	0.6000	0.0714
5	0.0291	0.0162	0.0000	0.0110	0.0667	0.0000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

(D) Correction Matrix for ages 2,3,4,5
(Inverse of Scale-CWT age proportion matrix.)

2	1.00000	0.00000	0.00000	0.00000
3	0.00000	1.01265	-0.02201	0.01321
4	0.00000	-0.01265	1.02201	-0.61321
5	0.00000	0.00000	0.00000	1.60000

(E) Corrected Scale age proportion vectors for scale-aged 2 - 5 fish

Age	WCW	w/age5	HUPANET	w/age5	LOWTRINREC	w/age5	TRH	w/age5	LOWTRINCAR	w/age5	UPTRINREC	w/age5
	see below											
2	0.2168		0.0566		0.2295		0.2145		0.0667		0.4286	
3	0.4794		0.4623		0.3732		0.5575		0.2577		0.5048	
4	0.2572		0.4552		0.3973		0.2103		0.5690		0.0667	
5	0.0466		0.0259		0.0000		0.0177		0.1067		0.0000	
	1.0000		1.0000		1.0000		1.0000		1.0000		1.0000	

(1) Recalculate WCW non-CWT
age-proportion vector using correction matrix:

Age	#	Uncorrected age vectors	WCW nonAd Age 2 - 5 Corrected Proportions
2	49	0.1870	0.1870
3	137	0.5229	0.5242
4	68	0.2595	0.2399
5	8	0.0305	0.0489
	262	1.0000	1.0000

WCW Non-Ad-Clip Scale Ages

Age	Total	
0	9	
2	49	
3	137	
4	68	Aged
5	8	262
Grand Total	271	

Note: Ad-clip fish were sampled at WCW more intensively than non-ad clip fish,
but non-Ad-Clip hatchery fish were necessarily sampled in the same random way as non-hatchery fish.
Therefore, the WCW corrected age-proportion vector is recalculated here using only ages of fish with no adipose clip.

Natural Escapement, Trinity basin above WCW: Apportioned to age structure.

Total Adults +Jacks above WCW	
Rec above WCW	643
TRH	4549
Naturals	13098
Total	18290

Age	TRH + Rec above WCW age proportions	Add each WCW + Nat Escapement
2	0.1870	3421
3	0.5242	9588
4	0.2399	4388
5	0.0489	894
	1	18290

Subtract known TRH and Rec

TRH	Upper Trinity Rec Harvest	Age
1034	170	2
2431	415	3
1004	57	4
80	1	5
4549	643	

Apportioned Natural Escapement
minus TRH #s minus above WCW creel #s

	Props
2217	0.1692
6741	0.5147
3327	0.2540
813	0.0620
13098	1

Used: Combo of #s: WCW (J&A scales)
- TRH (J&A scales)
- Rec harvest above WCW (J & A scales)